Solar Path, LLC
Advancing Sustainable Energy

Congresswoman Gabrielle Giffords and Pima County Public Library presents

Solar Power 101

A Community Education Series on Solar Energy

An Overview of Residential Solar Photovoltaic and Installation Steps

By

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Advancing Sustainable Energy

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FYI:

"I'd put my money on solar energy...I hope we don't have to wait till oil and coal run out before we tackle that."

Thomas Edison, in conversation with Henry Ford and Harvey Firestone, March 1931

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Quick Facts:

Sunlight is a clean renewable energy resource that has been used for many years. Photovoltaic panels convert energy from the sun into electricity. Some benefits of solar power are:

- Produces no emissions and is replenished naturally
- Reduces greenhouse gases
- Saves the release of 2 lbs. of carbon dioxide (CO_2) for each kilowatt-hour (kWh) produced
- Saves the use of one-half gallon of water for each kWh of solar energy produced
- Saves the release of other emissions that result from the burning of fossil fuels such as nitrogen oxides, sulfur dioxide or mercury
- Makes use of one of Arizona's greatest natural resources - sunshine
- Provides customers with options to reduce their electric bills.

--http://www.tucsonelectric.com/Green/Home/Solar/electric.asp--

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Terms to Know:

Solar insolation
Solar hours
Renewable Energy
Kilowatt (KW)
Kilowatt hour (KWh)
Photovoltaic panel
Inverter
Solar meter
Net meter
Upfront incentive (UFI)
Performance based incentive (PBI)

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How does it work:

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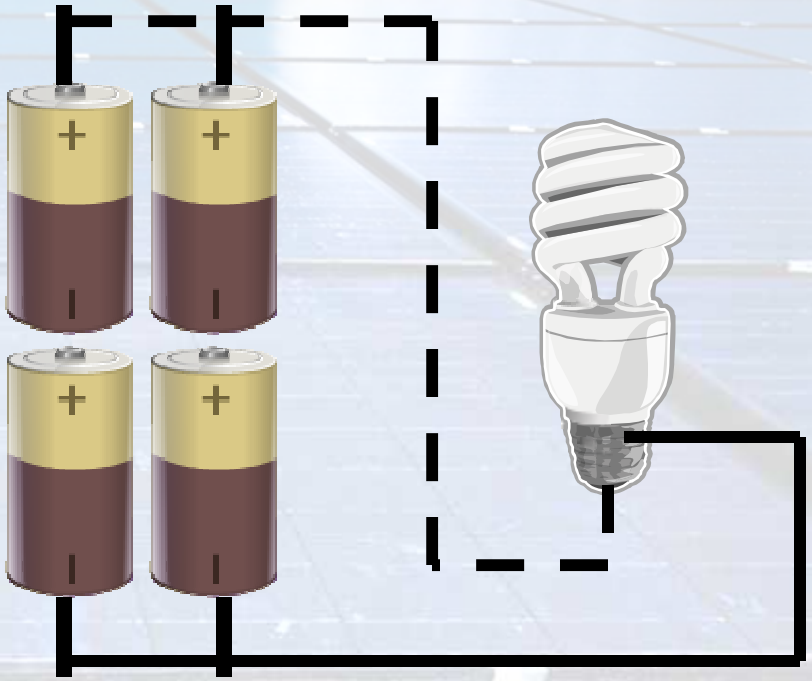
How does it work:

- Batteries working in series or strings for necessary voltage

- Batteries working in parallel for necessary amps



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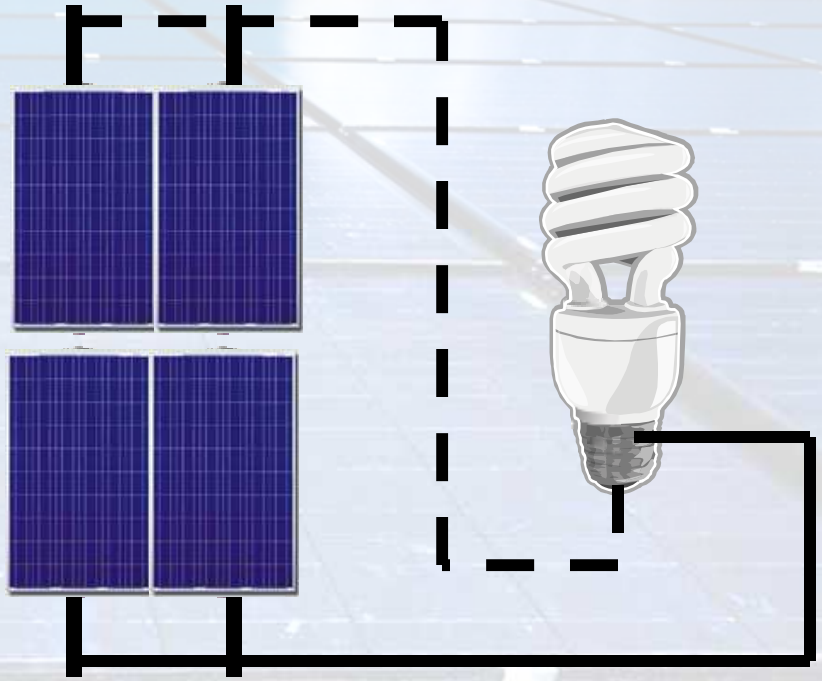
How does it work:

- Solar PV working in series or strings for necessary voltage

- Solar PV working in parallel for necessary amps



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How does it work (Grid-Tied):

DC Power

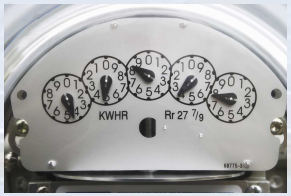
AC Power

PV Panel

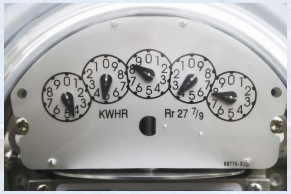
DC – AC Inverter

Breaker Box Electrical Panel

Utility Electric Grid



Electric Solar Meter



Electric Utility Net Meter

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Installation Process:

- Evaluate if my property is a good candidate for solar
- Determine the size of system to be installed
- Decide on installation method
- Produce and draw necessary Construction Documents
- Home Owners Association notification
- Sign utility company Applications and Contracts
- Utility review and preliminary approval of system
- Apply for a Permit and pass the review process
- Install system (Licensed Electrician Required)
- Pass inspection by Local Municipality
- Obtain Permit
- Pass Inspection by Local Utility
- Receive Utility Incentive

Approximately 2 – 8 Week Process **(not including incentive)**

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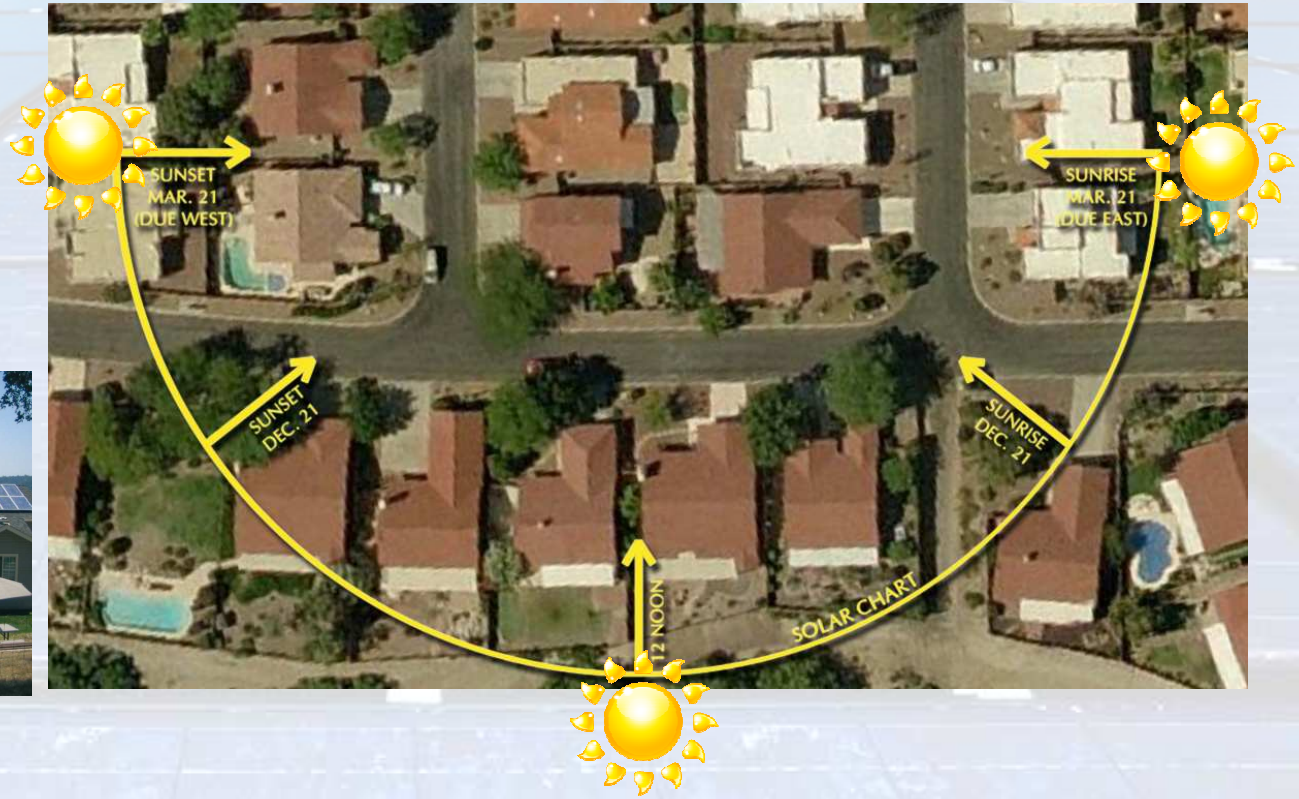
Installation Process:

- **Evaluate if my property is a good candidate for solar**

1. Roof Orientation?
2. Obstructions?



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Installation Process:

- **Determine the size of system to be installed**

How much solar do I really need?

Record average monthly kWH electrical use:	1,500	**kWH**
Multiply line 1 by the percentage you want the solar system to produce: *ie: 2000kWH X 50% = 1000kWH*	750	**kWH**
Divide by 30 for the daily output from your solar power system:	25	**kWH**
Divide by the daily average sun hours for your location (6.5):	4	**kWH**
Divide by 70% to compensate for system efficiency:	6	**kWH**
Multiply by 1000 watts/ kilowatt	6000	**kWH**

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Installation Process:

- **Determine the size of system to be installed**

How much solar do I really need? -- Compare to the chart

Example Household:

Calculated to a 20 year savings of $37,000*

1,500	kWH
750	kWH
25	kWH
4	kWH
6	kWH
6000	kWH

System Size DC	Estimated Annual System Production
1 kW	1700 KWh
2 kW	3400 KWh
3 kW	5100 KWh
4 kW	6800 KWh
5 kW	8200 KWh
6 kW	10200 KWh
7 kW	11900 KWh
8 kW	13600 KWh
9 kW	15300 KWh
10 kW	17000 KWh

*Projections made on an estimated starting cost of $.105/kWh with a 3.5% projected increase

http://www.tucsonelectric.com/faqs/faqlist.php?faq=SolarPV

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Installation Process:

- **Decide on installation Method**

Roof Mount

Permanent vs. Removable?

Ground Mount

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Roof Mount:

Flat Roof

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Roof Mount:

Sloped Tile Roof

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Ground Mount:

Ground Array

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Ground Mount:

http://www.mavericksolar.net/mounts/Mounts_Pole_Example_01.jpg

Pole Mount

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Electric Utilities/ Renewables:

Tucson Electric Power

Sun Share tm

Trico Electric Coopertive

Sun Watts tm

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TEP/ Sunshare$_{tm}$:

Tucson Electric Power
A UniSource Energy Company

SunShare

Available Residential Programs:

Solar Photovoltaic
Grid Tied Upfront Incentive
Off-Grid Tied Upfront Incentive

Solar Thermal
Residential Hot Water
Retroactive Residential Hot Water

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TEP/ Sunshare$_{tm}$:

Tucson Electric Power
A UniSource Energy Company

SunShare

Available Commercial Programs:

Solar Photovoltaic
Grid Tied Upfront Incentive
Performance Based Incentive

Solar Thermal
Commercial Hot Water
Commercial Pool Heating

Daylighting
Commercial Daylighting

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TEP/ Sunshare$_{tm}$:

Tucson Electric Power
A UniSource Energy Company

SunShare

Solar Photovoltaic Upfront Incentive:

Residential Grid Tied

SYSTEM CAPACITY SIZE X $3.00 PER WATT = TOTAL INCENTIVE PAYMENT

28 KW DC LIMIT X $3.00 PER WATT =

UP TO $84,000 TOWARDS YOUR SYSTEM

Commercial Grid Tied

SYSTEM CAPACITY SIZE X $2.50 PER WATT = TOTAL INCENTIVE PAYMENT

142 KW DC LIMIT

(TEP may not pay for more than 60% of the total cost of the project. The TEP incentive payment combined with all federal and state incentives may reach only 85% of the total project cost. Calculations based on 20kw AC / 70% = 28kw DC -- 100kw AC / 70% = 142 kw DC.)

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TRICO/ Sun Watts$_{tm}$:

Available Programs:

Solar Photovoltaic

Grid Tied Upfront Incentive
Off-Grid Tied Upfront Incentive
Performance Based Incentive

Solar Thermal

Residential Hot Water

Wind

Grid Tied Upfront Incentive
Off-Grid Tied Upfront Incentive

Geothermal and Biomass

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TRICO/ Sun Watts$_{tm}$:

Solar Photovoltaic Upfront Incentive:

Residential and Commercial

SYSTEM CAPACITY SIZE X $3.00 PER WATT = TOTAL INCENTIVE PAYMENT

10 KW DC LIMIT X $3.00 PER WATT =
UP TO $30,000 TOWARDS YOUR SYSTEM

(Trico may not pay for more than 40% of the total cost of the project and has a generating capacity less than or equal to125% of your total connected load.)

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Government Tax Credits:

Federal Government:

A federal tax credit of 30 percent of the cost of solar equipment and installation, with no cap on the tax credit.

Arizona State Government:

A residential state tax credit of up to $1,000 is available, based on 25 percent of the cost of solar equipment and installation.

For commercial the limit is up to $25,000

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Estimated System Costs:

Solar Photovoltaic with Upfront Incentive from Tucson Electric Power:

Estimated Pricing for Comparison				
PV Panel Wattage DC	220			
Price per Watt		$6.90	$6.80	$6.70
PV Panels		12	14	24
System Size		2,640	3,080	5,280
Installed Price		**18,216**	**20,944**	**35,376**
Max Utility Upfront Incentive		7,920	9,240	15,840
Installed Price after TEP		**10,296**	**11,704**	**19,536**
Additional Credits				
State Personal Tax Credit		1,000	1,000	1,000
Est. 30% Federal Credit		3,089	3,511	5,861
Installed Price After Incentives		**6,207**	**7,193**	**12,675**

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Common Questions about Solar:

Where does the incentive money come from?

Funding for the .. (*incentive)* program comes from the Renewable Energy Standard Tariff (REST), a surcharge placed on all members' bills. This surcharge is mandated by the Arizona Corporation Commission (ACC). All utilities under the ACC's jurisdiction assess this surcharge. -- *Trico Sun Watts Guide* –

REST agreement is voted on by the ACC every year.

You are paying for this right now!

So take advantage of the Available Incentives!

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